Earth System Research Laboratory
Physical Sciences Division

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Denver

Seasonal Outlook into the Summer of 2014

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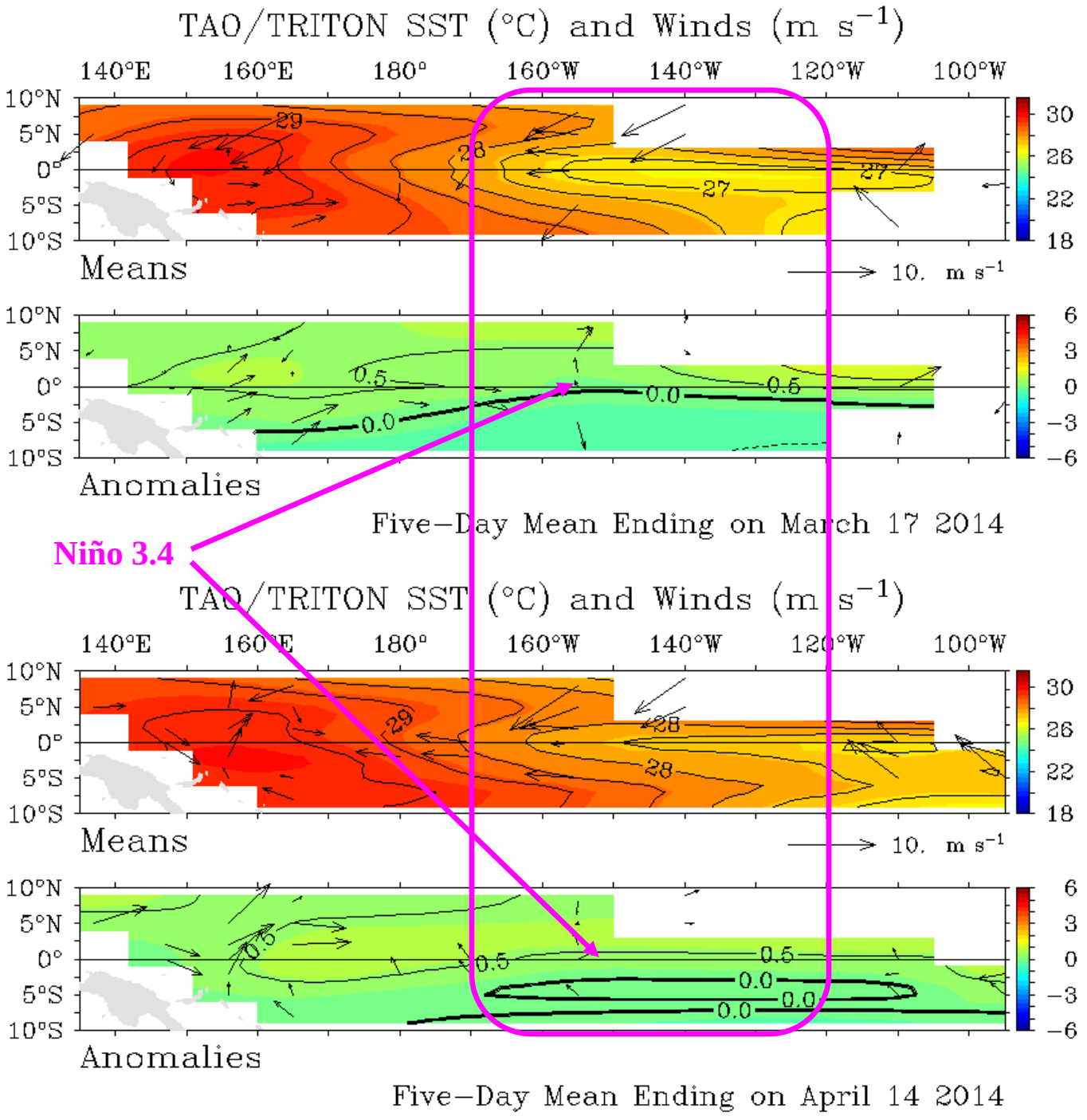
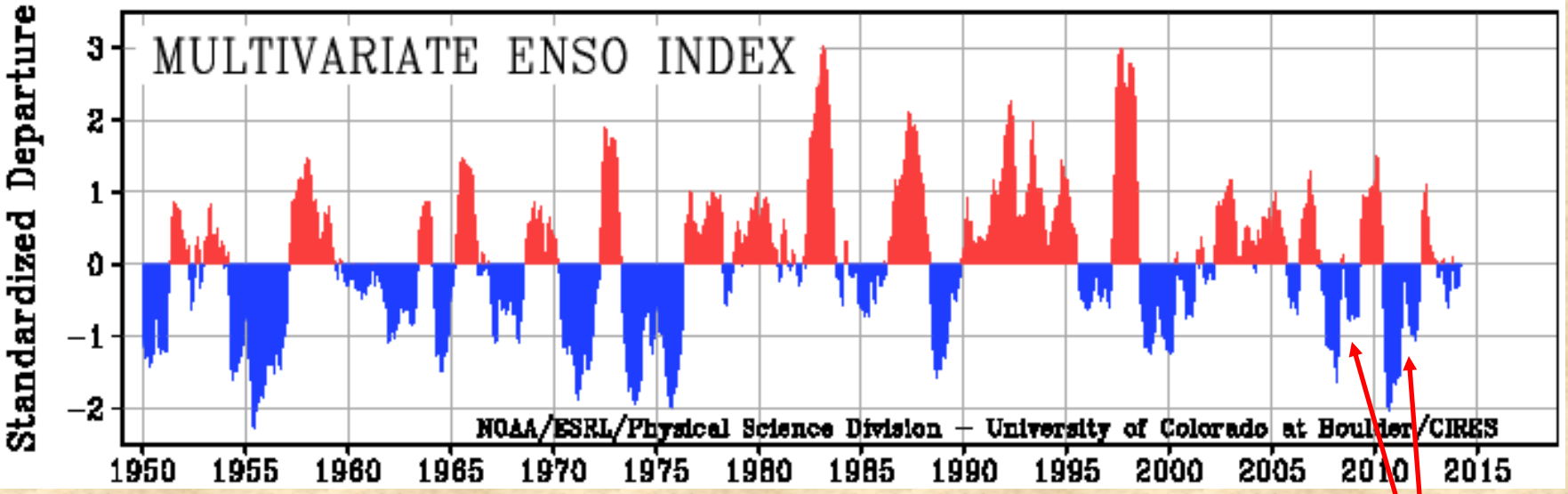
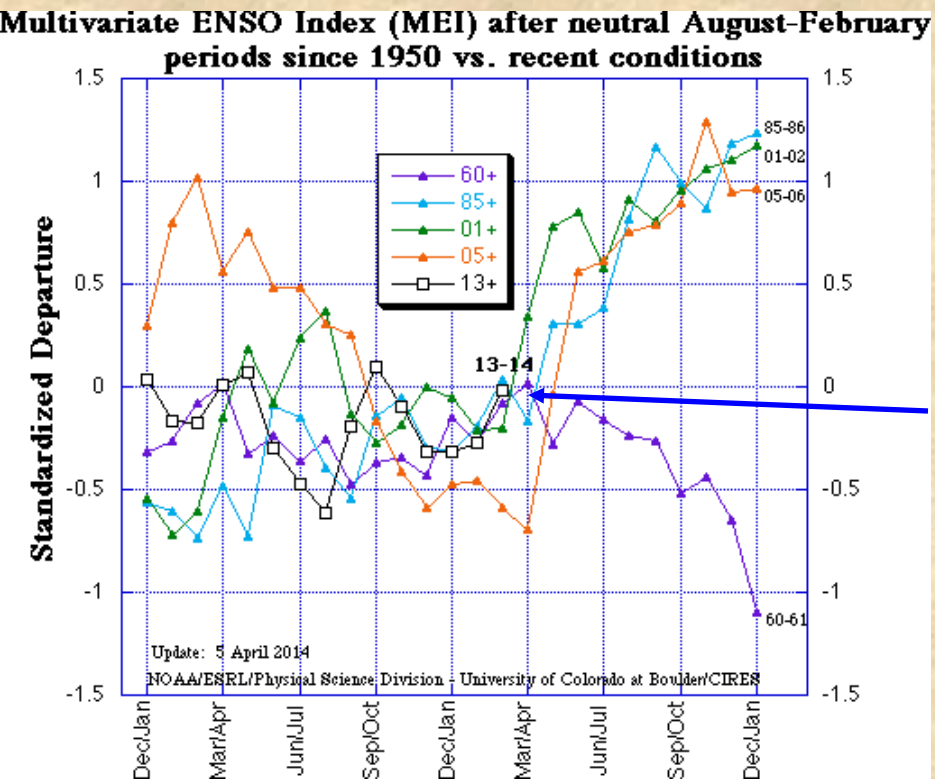
- **What has happened to ENSO(+), what will happen next, and what does that mean for us ?**
- **Expectations for the next two weeks**
- **CPC forecasts for April through September 2014**
- **Seasonal Forecast Guidance for precipitation & *1jun SWE***
- **Executive Summary**

Current state of El Niño/Southern Oscillation (ENSO) phenomenon (bottom), compared to last month (top): Current wind (& subsurface) anomalies are consistent with developing El Niño conditions, in fact, the subsurface warming (not shown) remains the most dramatic component evolving over the last month or two.



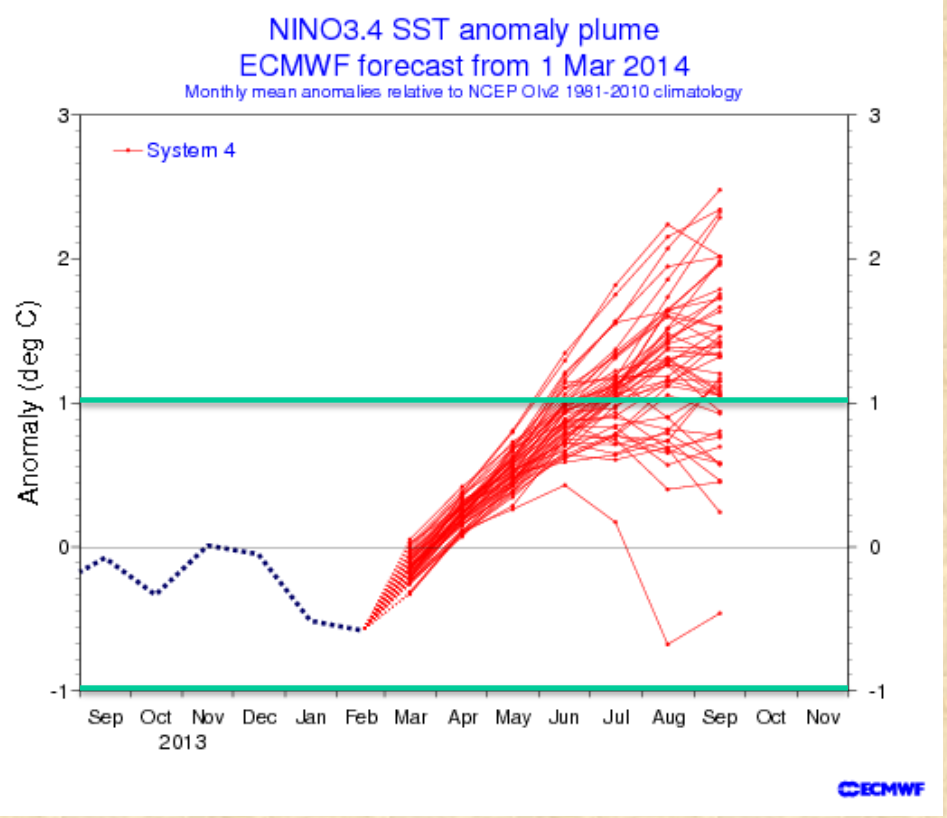




Last seven years have seen two 'double-dip' Las Niñas in a row, followed by a brief excursion to what looked like an El Niño event in 2012, and a return to ENSO-neutral or weak La Niña conditions for much of the last year.

What the figure on the left illustrates is how fast conditions can change during our spring season, and most often towards El Niño, currently at least with a 2/3 chance.

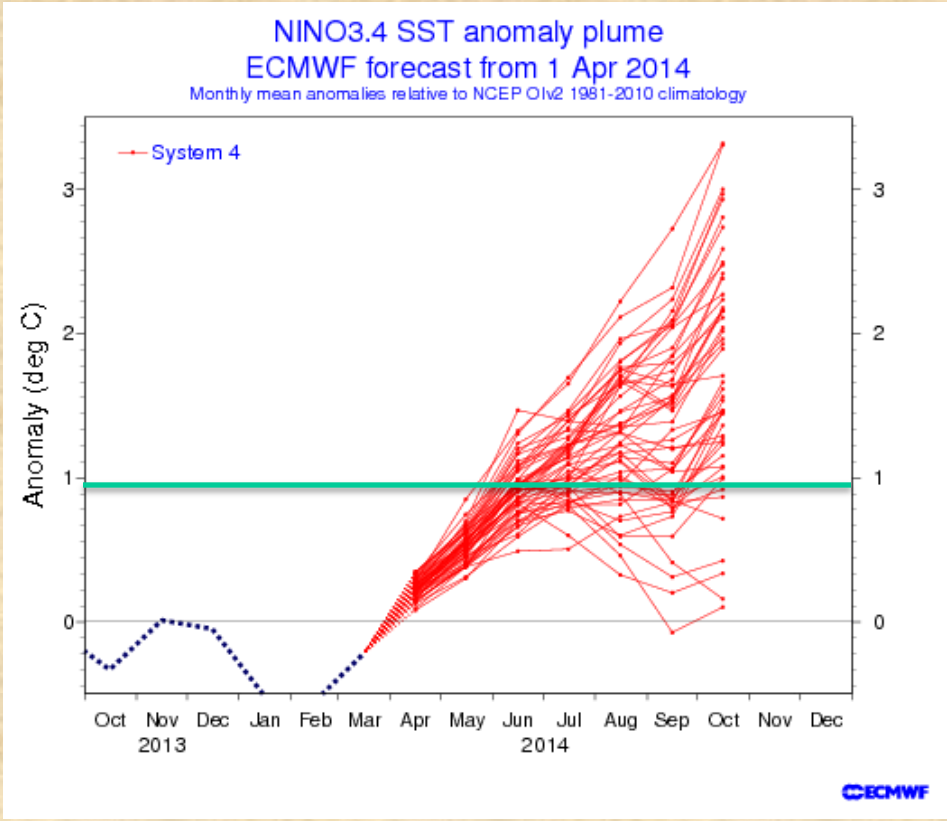
http://www.esrl.noaa.gov/psd/enso/mei



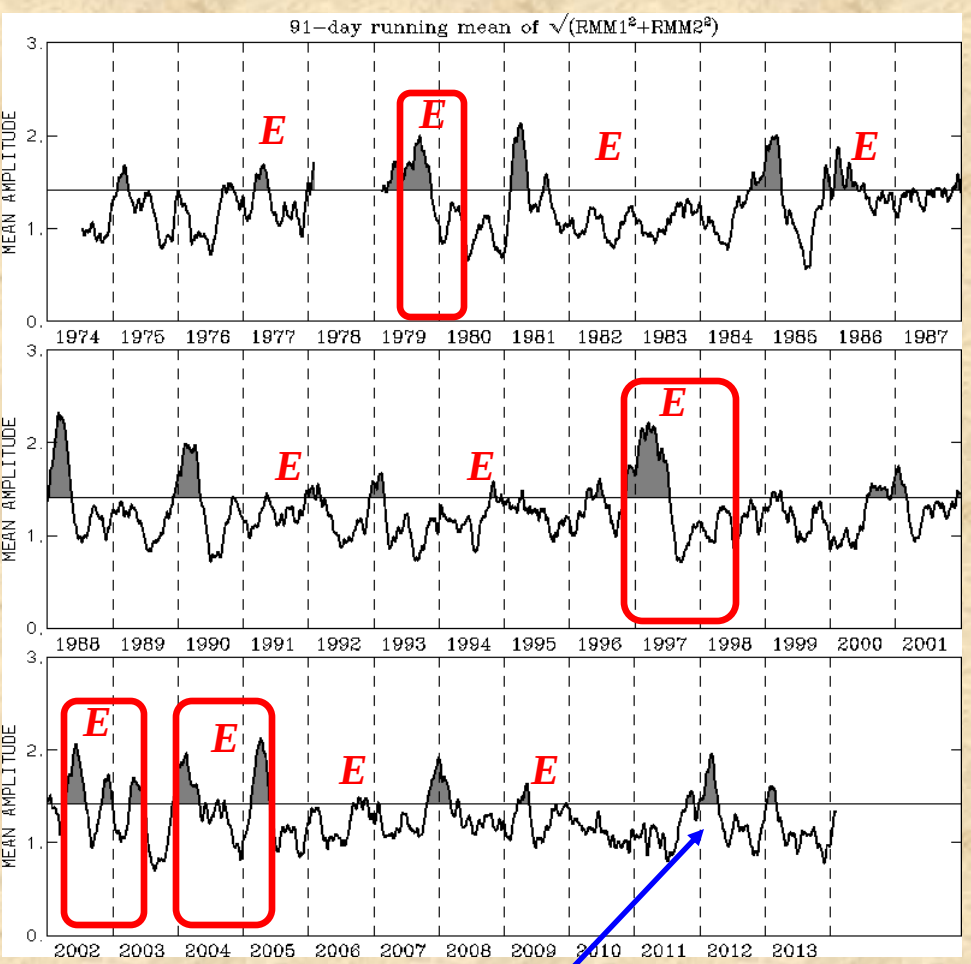
Last month's ECMWF forecast (left) had near-unanimous support for a transition to El Niño by June 2014 – *with one lone dissenter out of 50*. My own ENSO forecast basically agreed with that (*67% chance for El Niño and 0% for La Niña by late summer*).

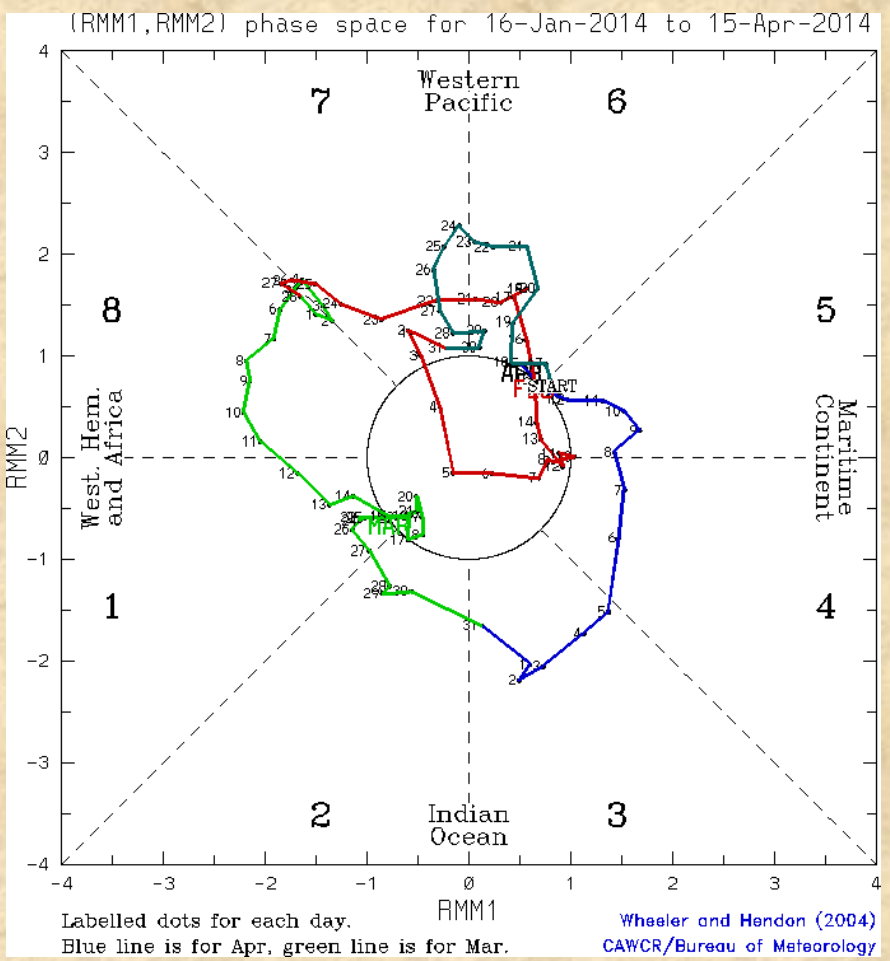
The ECMWF April 2014 forecast (right) is even more lopsided, with NO La Niña prospects in 2014, but about a 80-90% chance of hitting +1° C (moderate size), and at least 1/3 chance of hitting +2° C! ***The IRI plume is not in yet, but should have the same look overall.***

http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/seasonal_range_forecast/



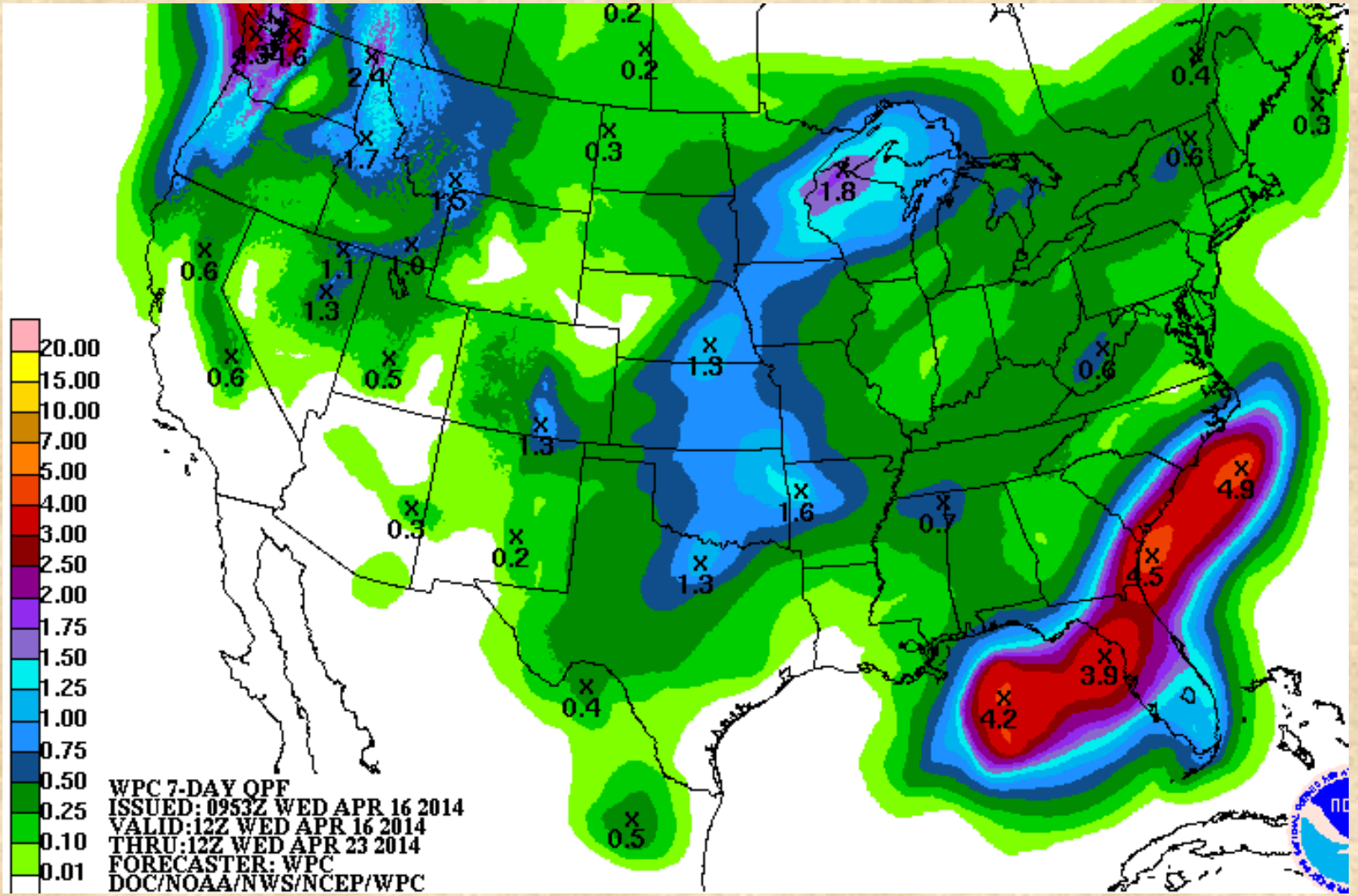
Jumpstarting El Niño?





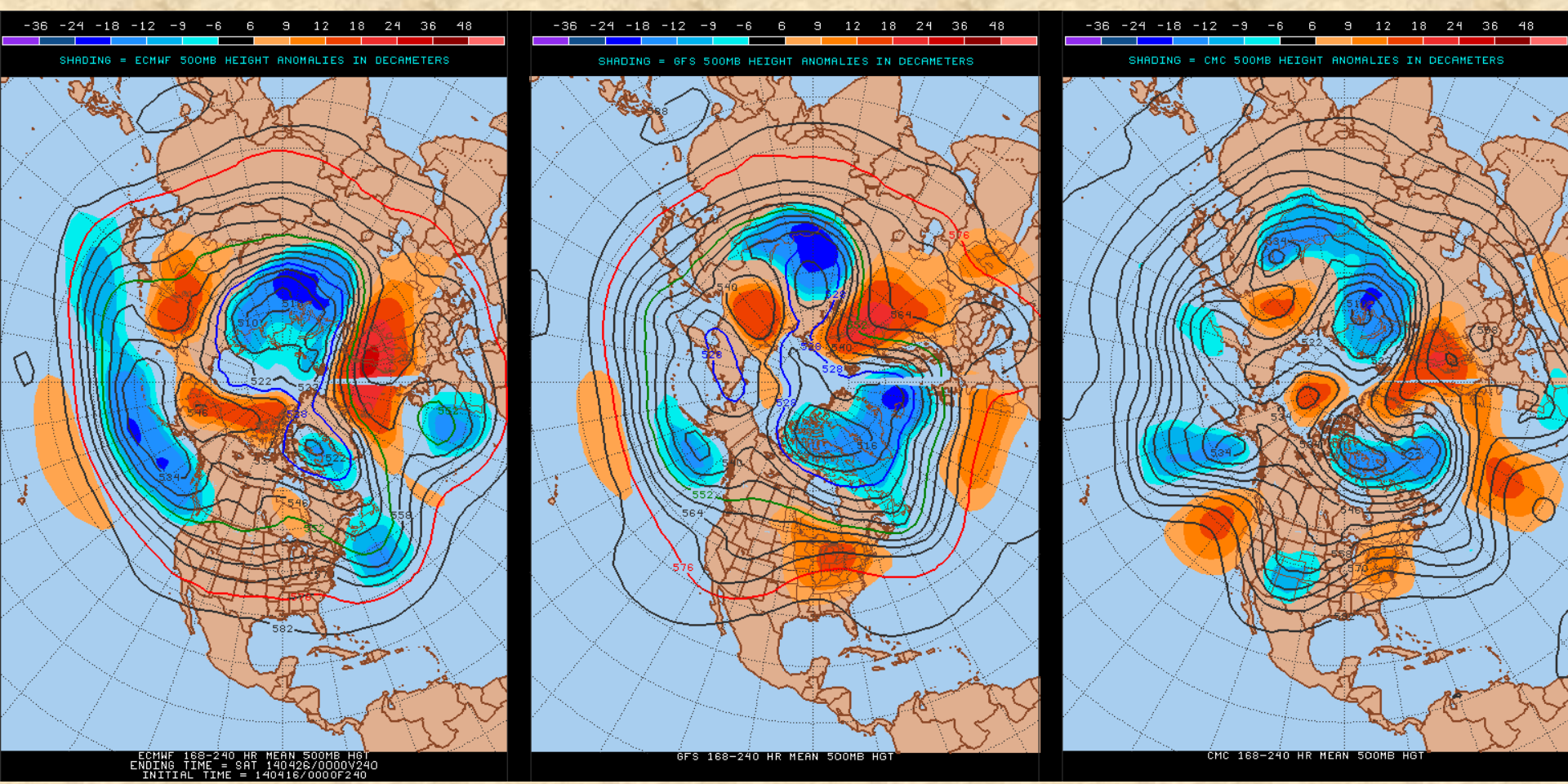
While some El Niño onsets (such as 1997) can clearly be associated with an intraseasonal event ('MJO'), many are not, but it is a factor to be considered. The last attempt (2012) 'failed', but the current run has completed one full circle, so it should have more impact (it was more sustained than in 2012.

What can we expect in the next seven days?



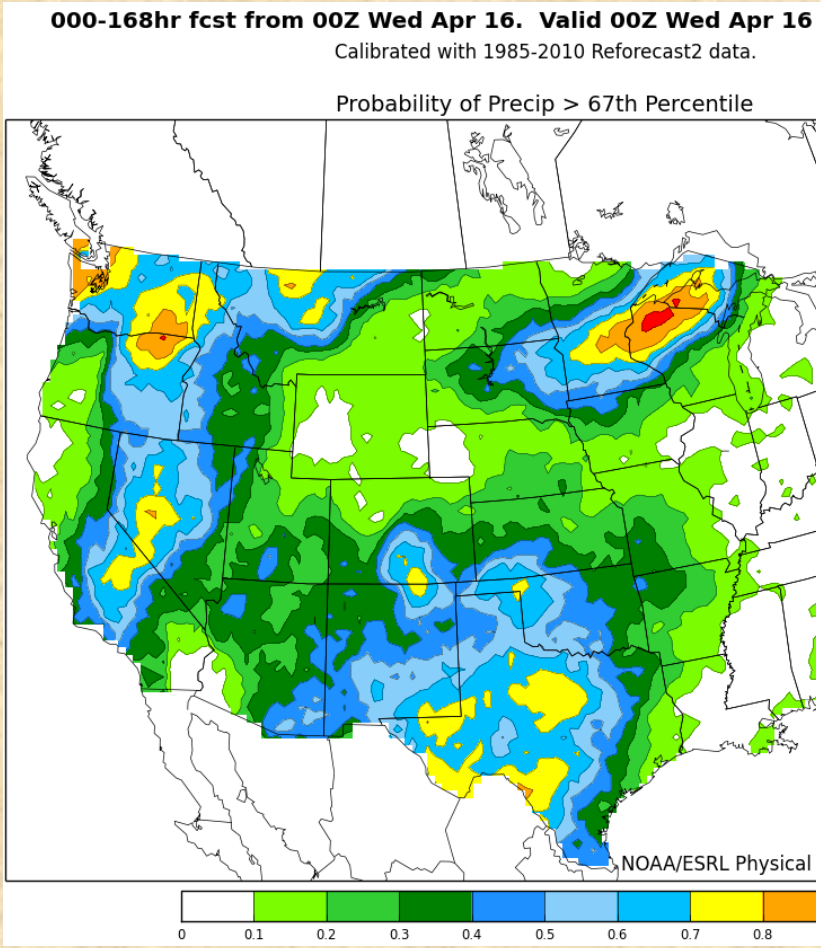
Expected total precipitation, according to the Hydrological Prediction Center (NOAA): Finally some drought relief for SE Colorado, not much new snow for the mountains (and that's o.k.) – the incoming storm is going to stay weak for us.

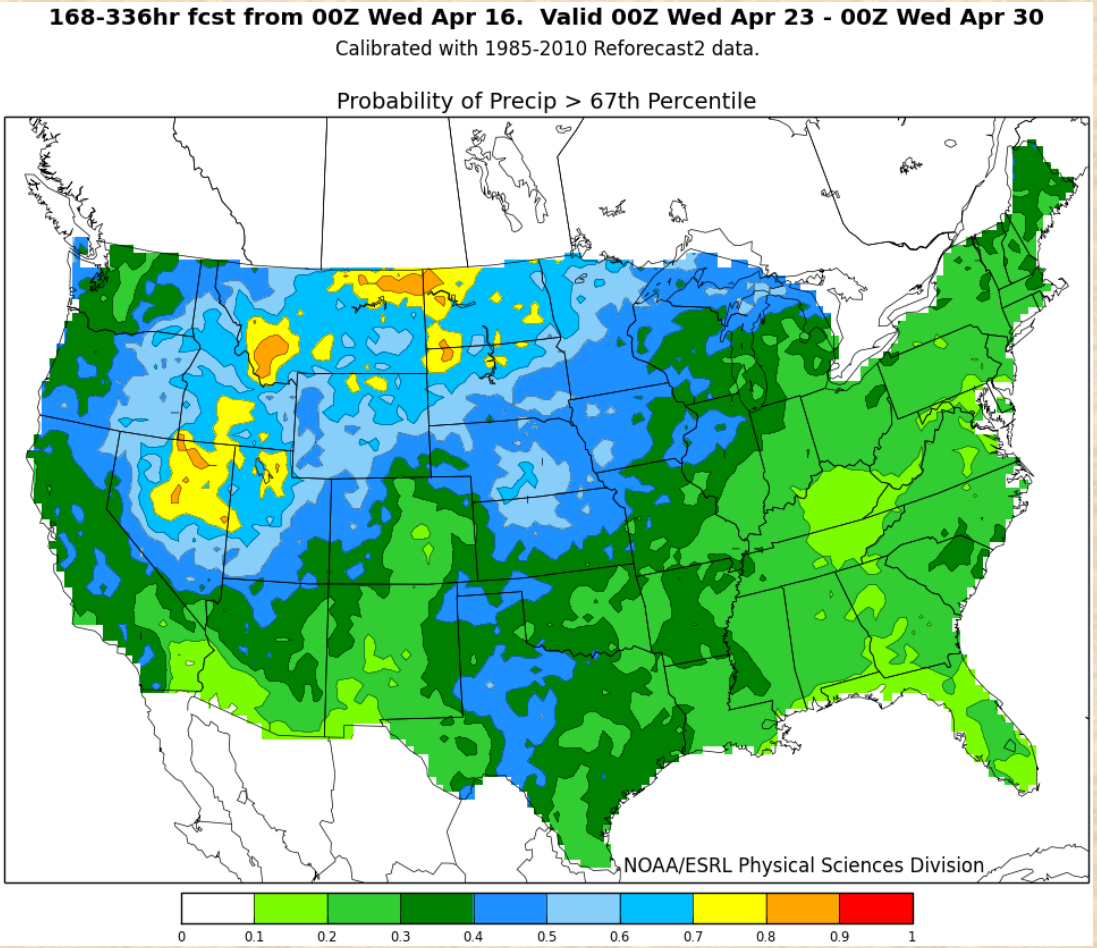
What can we expect later next week?



No major anomalies for us 7-10 days from now, pattern has again 'feel' of a transitional situation, with the possibility of troughing over us (Canadian version, right). For those who care, this situation reminds me of April-May 1991.

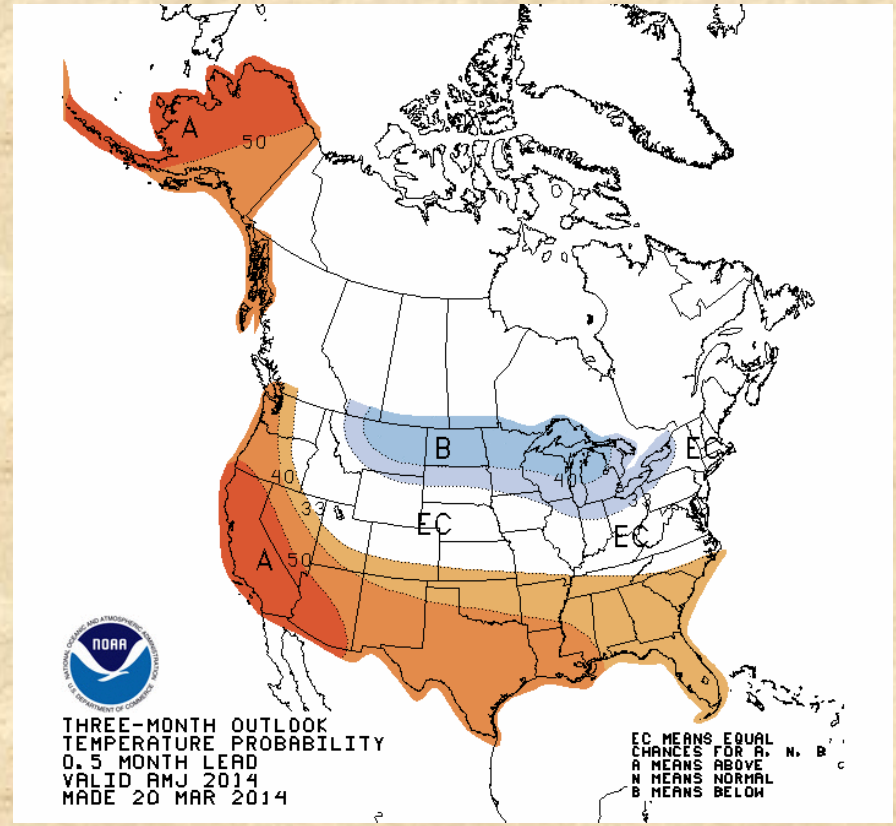
What do the ‘Reforecasts’ say?

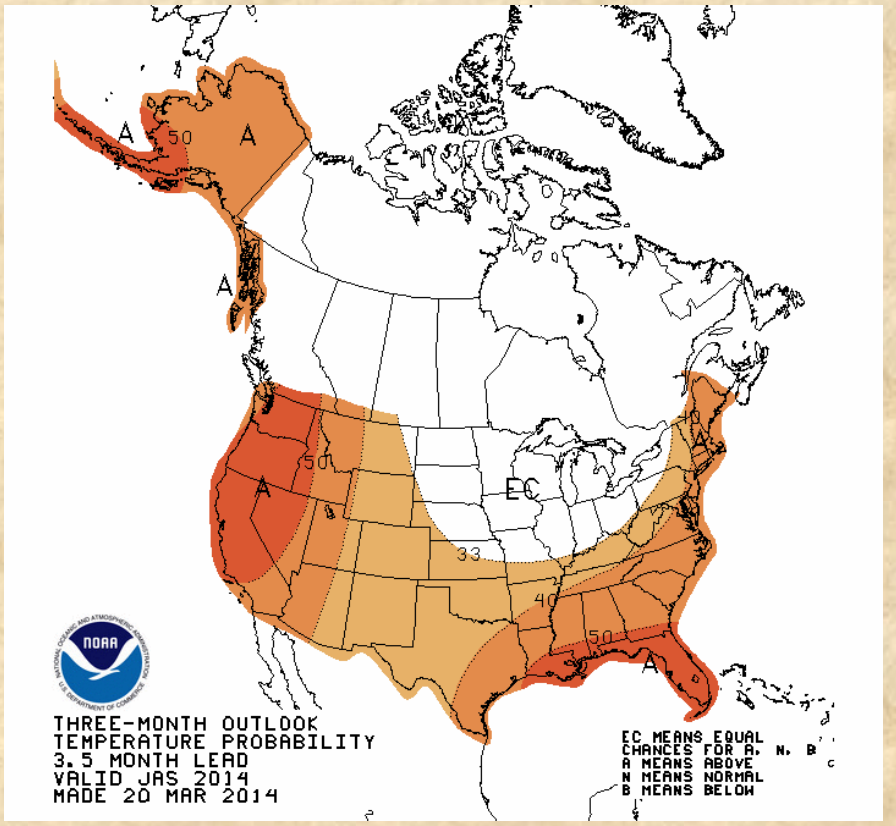




In a major departure from years of drought to our south, it looks ‘wet’ during the 1st week of this forecast period (left) from SE AZ into TX (and southern CO). The storm track shifts to the north in Week 2 (right), with most of CO looking dry for now.

Climate Prediction Center Temperature Forecasts

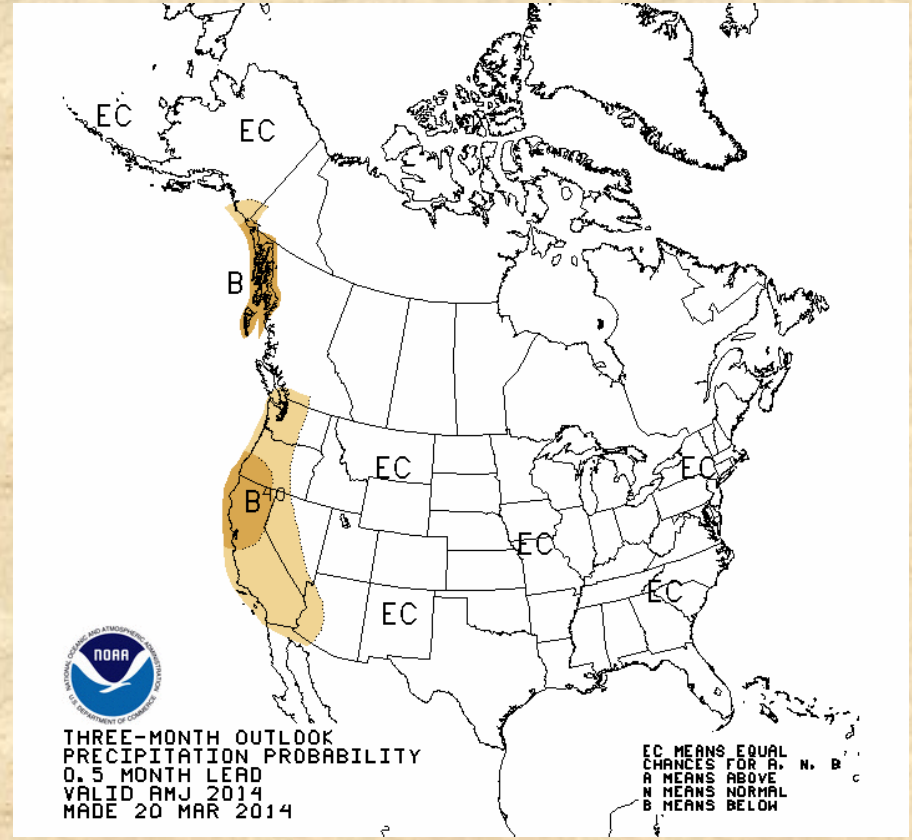


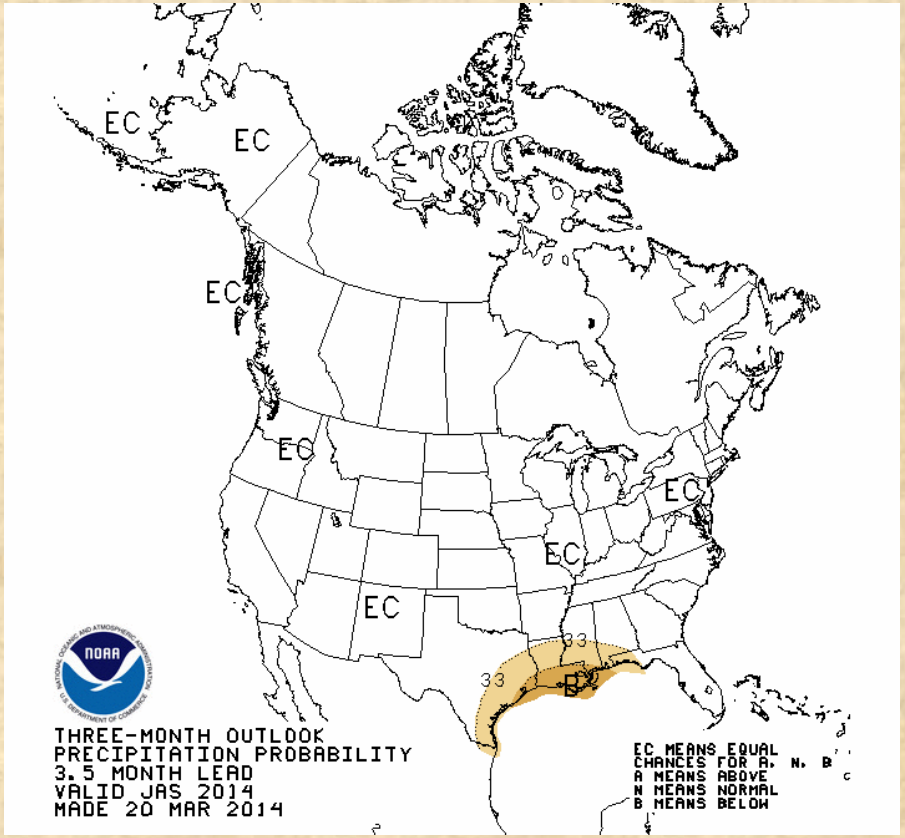


Colorado was predicted to remain on the fence with regard to temperatures this spring (left), with persisting cold over the Midwest and warmth towards CA. The summer forecast (right) continued the overall pattern. There will be tweaks to this pattern upon the new release of this forecast.

Source: ***http://www.cpc.ncep.noaa.gov/products/predictions/***

Climate Prediction Center Precipitation Forecasts

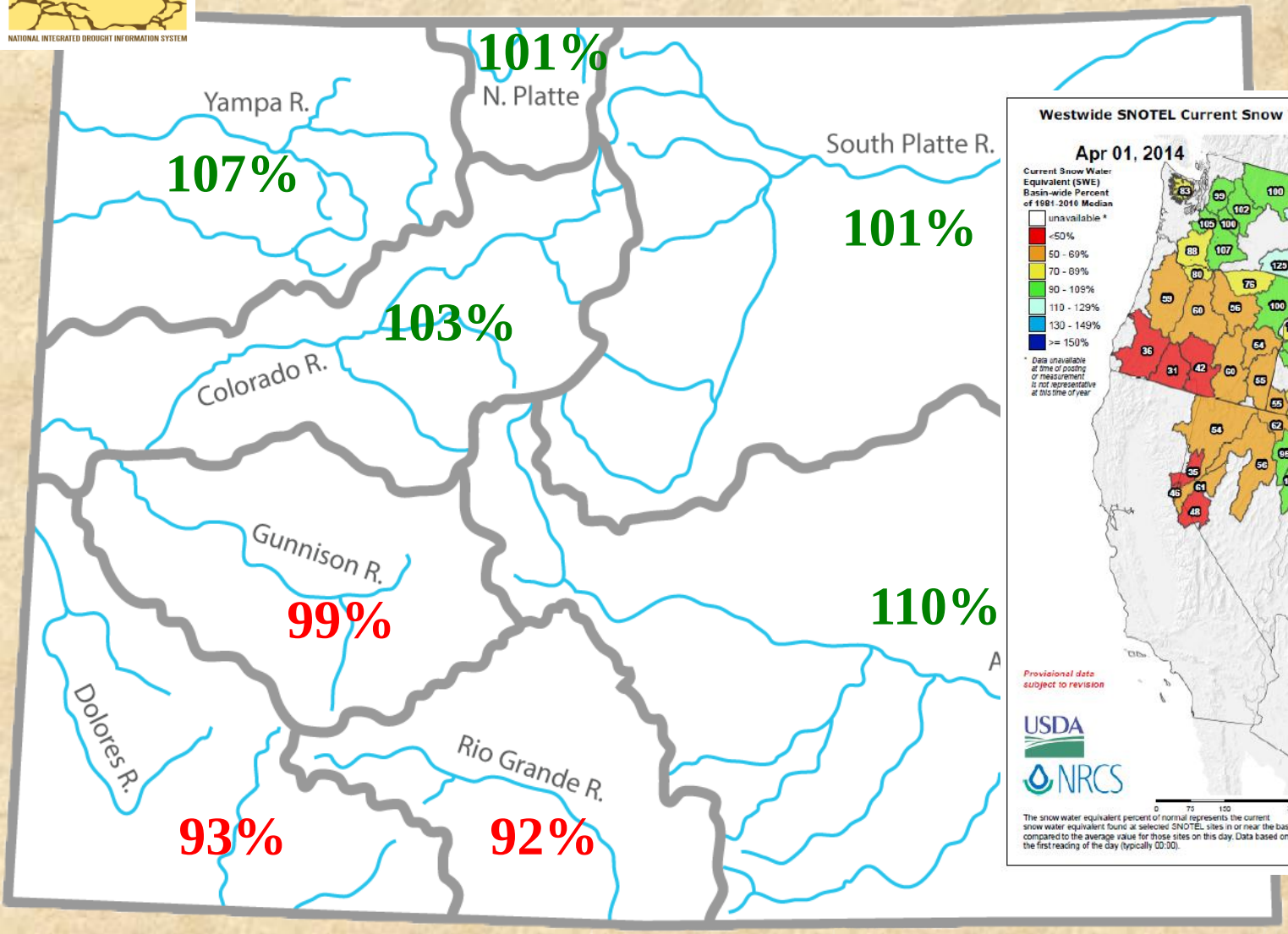


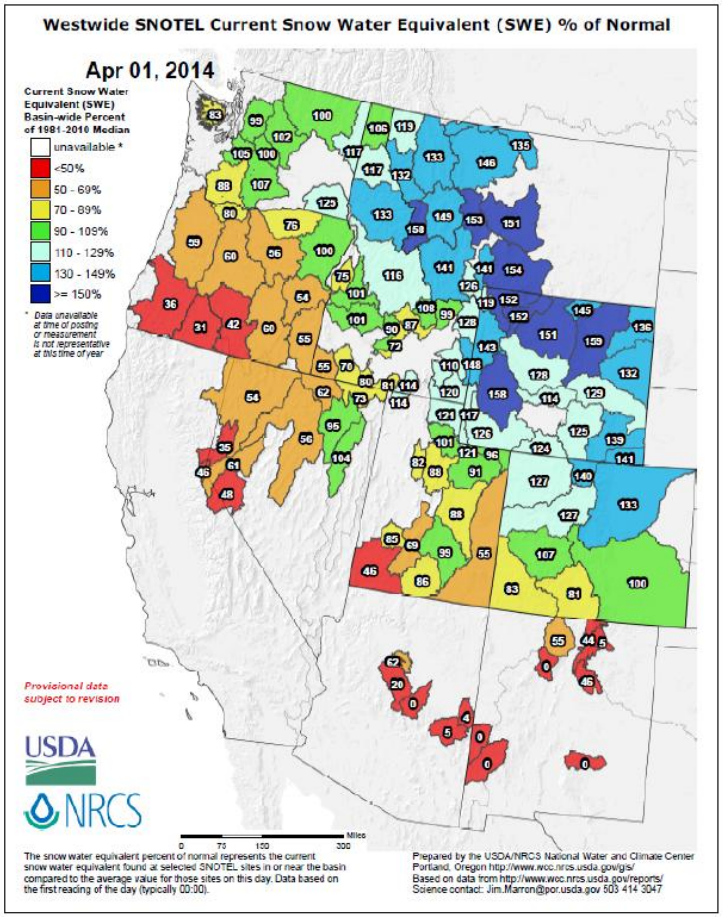


There was little agreement among CPC forecast tools for the next six months, except for continued drought along the West Coast in spring (left) and along the Gulf Coast during the summer (right). The new forecast will take into account that an El Niño is developing and that the models have been advertizing wetness over this region. Thus, tomorrow's new maps will look quite different.

Source: ***http://www.cpc.ncep.noaa.gov/products/predictions/***

SWE forecast for 1 April 2014 (50%ile)

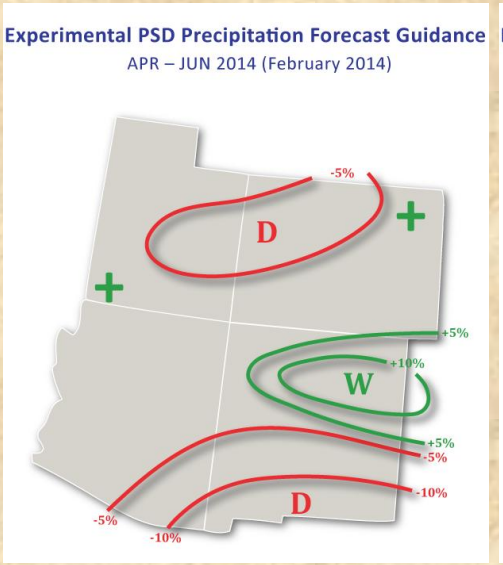


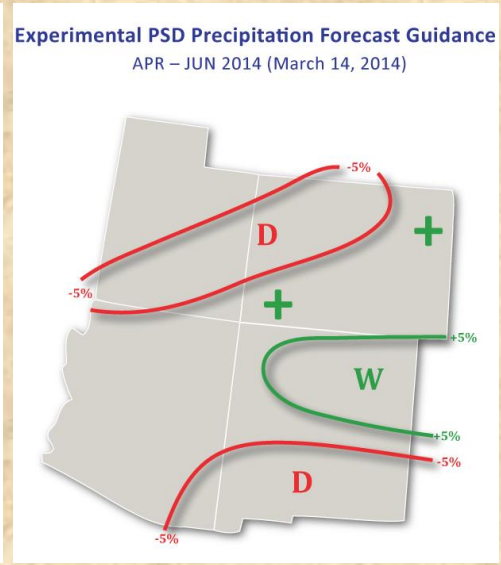


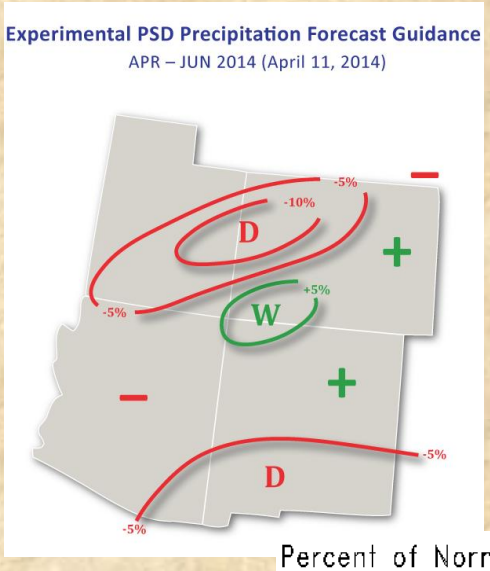
My median forecast for 1 April snowpack made in January was higher than the long-term median in the northern & eastern basins, in contrast to the southwestern basins.

While not catching the size of some of the anomalies, the overall pattern was well anticipated.

Statistical Forecast for April-June 2014

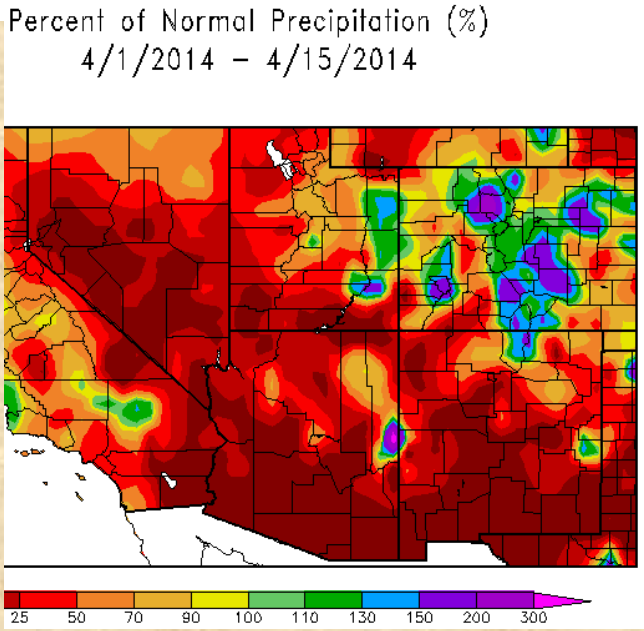




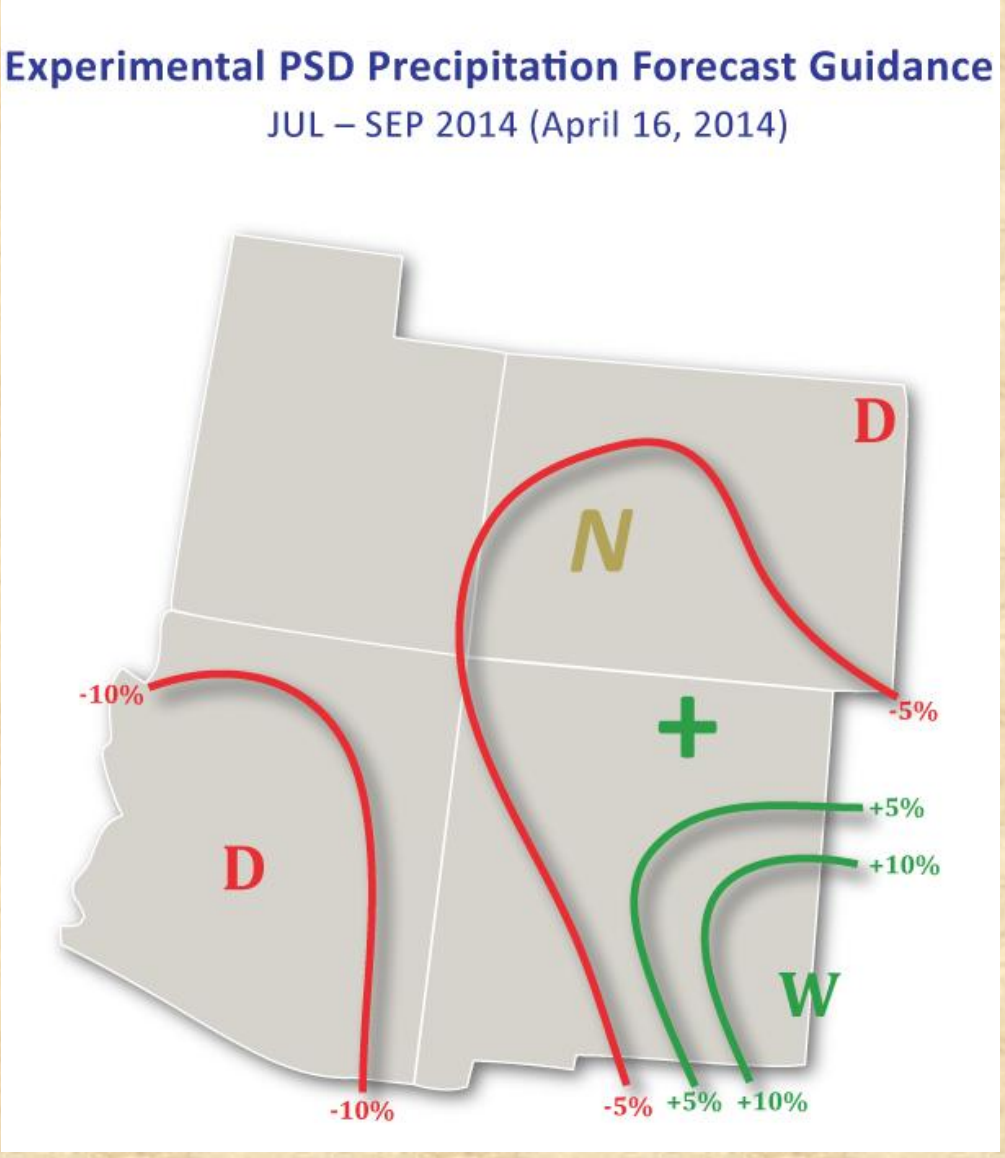


My forecasts for April-June 2014 from February (left), March (middle), and April (top right) show slightly increased chances for moisture in the southeastern half of CO (where they could use it) and less in the northwestern half, with increasingly better news for the San Juans. ***Operational skill has been best over UT and CO.***

So far, April has been wet over higher elevations in CO.



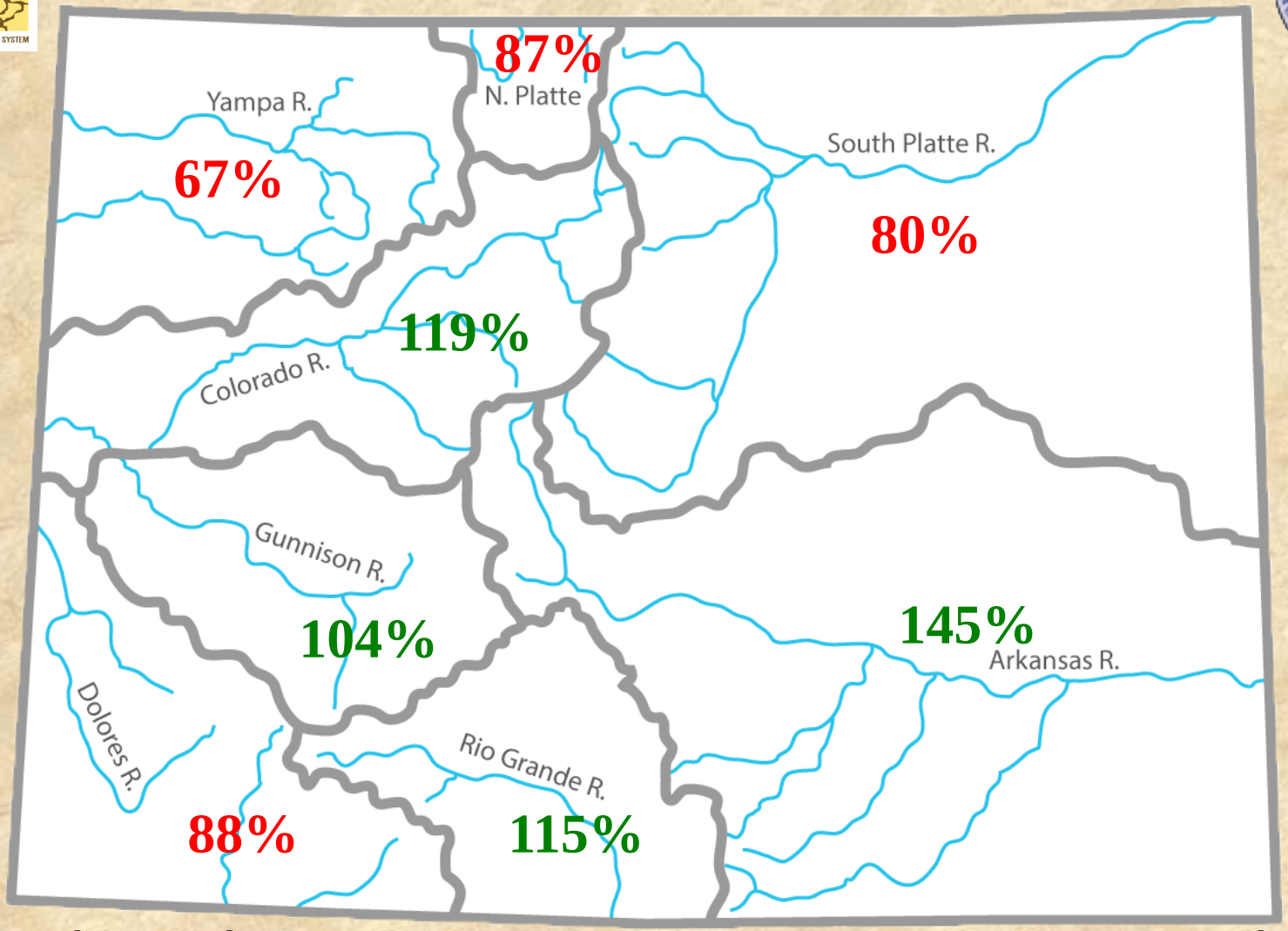
Statistical Forecast for July-September 2014



My first seasonal forecast for July-September 2014 is surprisingly dry for much of the interior southwestern U.S., although driest over AZ where El Niño often results in dry conditions during the summer. ***Operational skill is quite poor this far out, but best over NM where a wet summer is predicted for much of the state.***

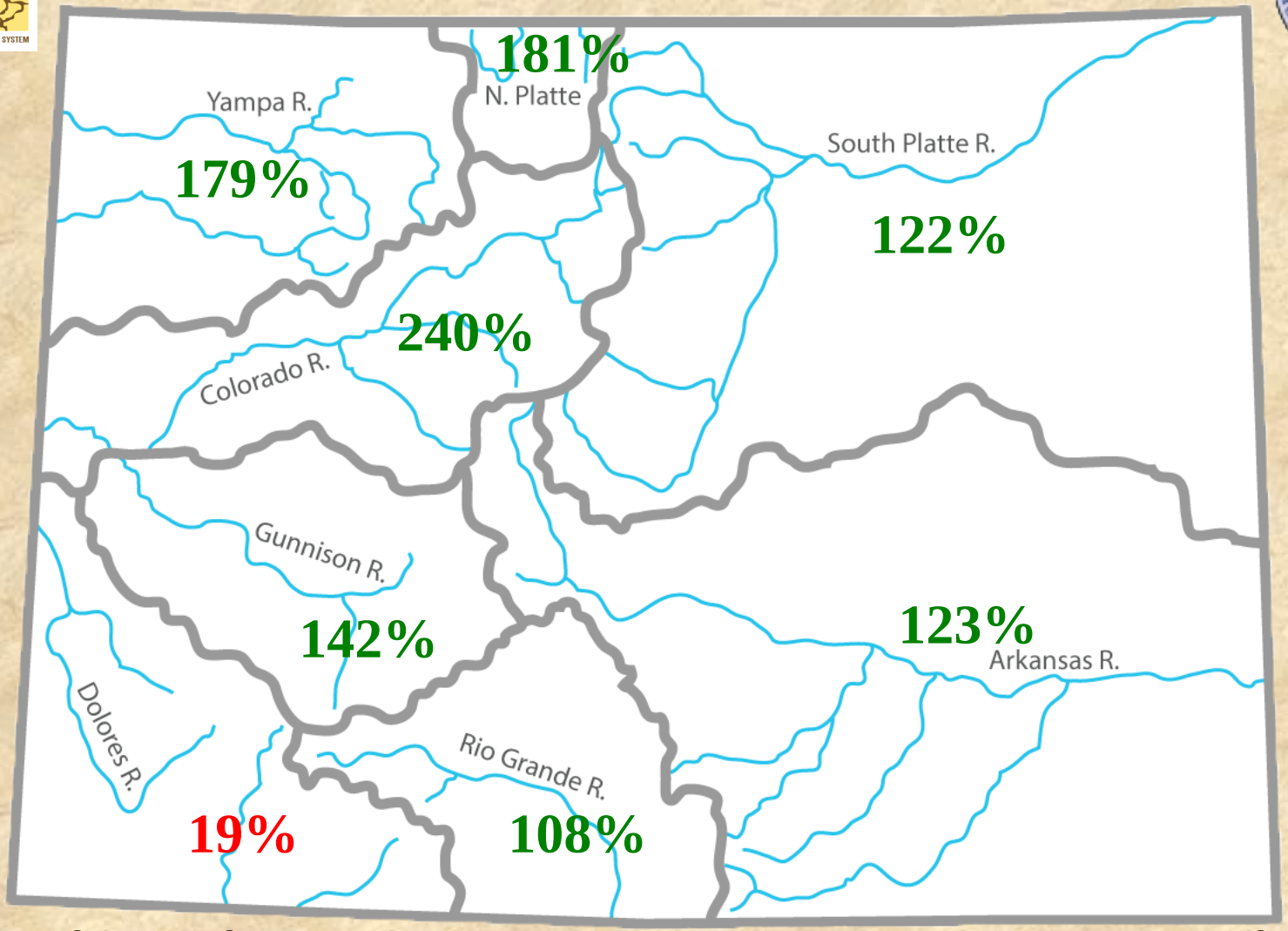
Stay tuned for the update in June!

SWE forecast for 1 June 2014 (50%ile)



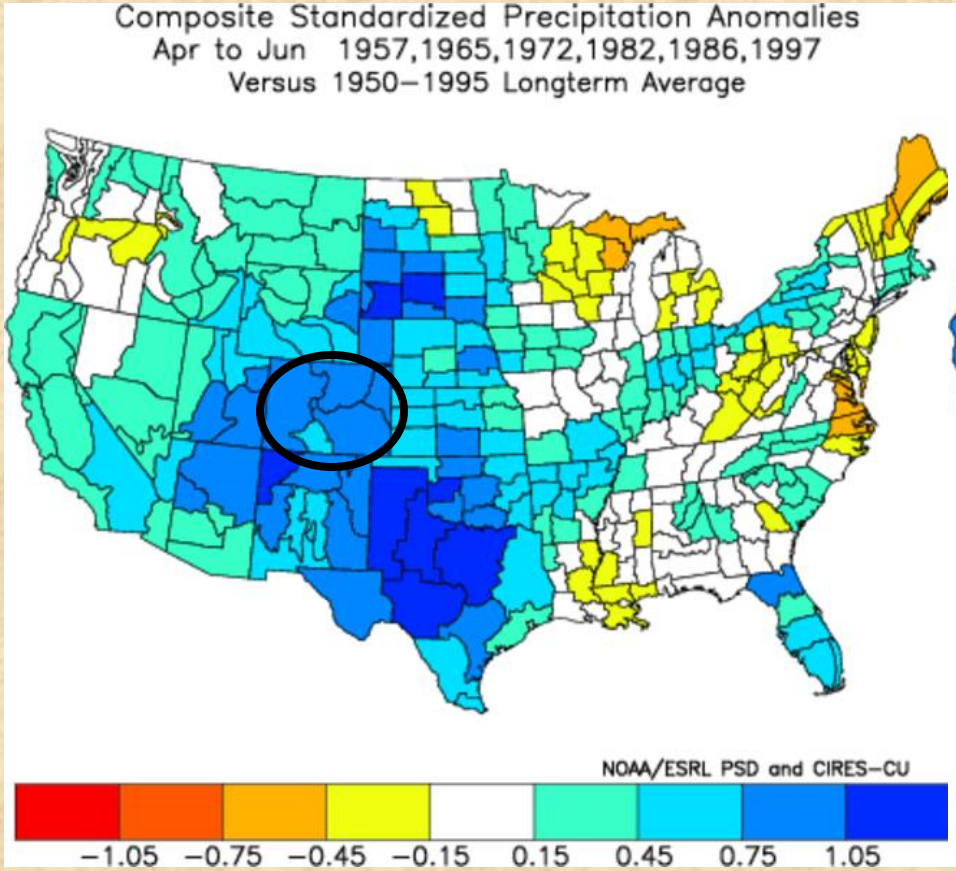
My median forecast for 1 June snowpack is higher than the long-term median from the Colorado River basin southeastward, and lower for the western San Juans as well as to the north and east. Snowpack this late in season is a function of preceding moisture and spring temperatures, complicating this particular forecast season. *Update will follow next month.*

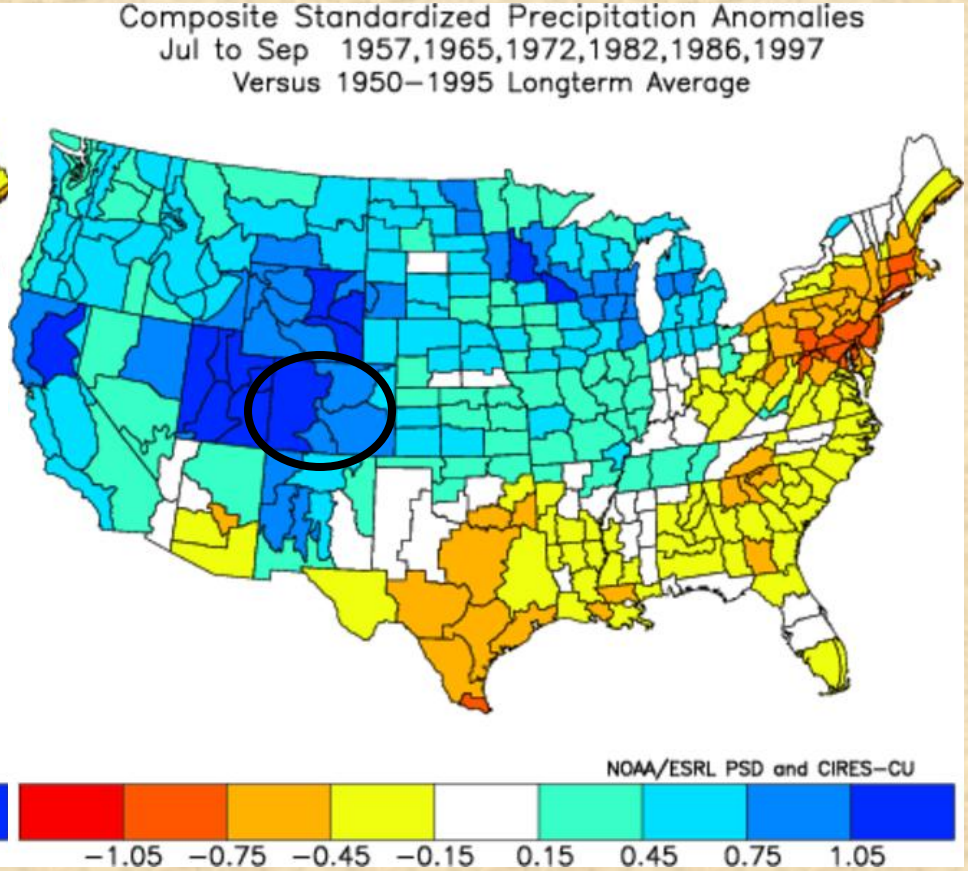
SWE forecast for 1 June 2014 (50%ile)



My median forecast for 1 June snowpack is higher than the long-term median for most of the state, even in regions where 1 April snowpack was low (Rio Grande). The forecast is apparently latching onto the developing El Niño situation.

Transitioning to El Niño?





If we really are on track towards an El Niño, the upcoming six months will be more likely on the wet than dry side, based on these updated composites that pick years that are most similar to the MEI behavior of the last four months. Depending on the region and season, 4-5 out of 6 developing El Niño events had the same (wet) sign of the anomaly for CO.

Any anomaly over 0.75 standard deviations is considered significant, i.e., most of CO in spring and summer!

Notes on flooding risks in 2014

SNOWMELT-RELATED:

- ***High snowpack** continues to increase the snowmelt-related flooding potential in South Platte basin in particular (just where we don't need it). Snowmelt is in full swing below 9K, and started below 10K.*

- ***Increased dust loads** compared to last month can be found across the state.*

- *Active storm track this winter and early spring means a lowered risk of stationary 'heat waves' that could trigger an early melt surge (last week came close).*

FLASHFLOOD-RELATED:

- *Some of the most prominent examples of flash-flooding occurred during **El Niño onset years ('65, '76, '97; also: 1896, 1904, 1911)** – odds for that are the highest since 2009.*

- ***Soil moisture and water table** have remained high in regions hit by September floods. All natural **reservoirs** are also about as full as I have ever seen around here going into spring (have man-made ones all been drained ahead of spring-runoff?). Reservoirs that are still full would have a lot less 'wiggle-room' in dealing with new inflow. A lot of temporary fixes to our infrastructure may end up getting severely tested.*

Executive Summary (16 April 2014)

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- **While El Niño/La Niña can provide decent guidance for climate outlooks around here, this was not very helpful in two years of ENSO-neutral conditions. We are now on track for El Niño to emerge within a month or two. This should favor lower elevations in particular with moisture during the growing season.**

- **New forecasts for snowpack conditions on the 1st of January and April held out the promise of a near-normal year, or much better than in 2012 and 2013. Snowpack is highest compared to normal exactly where we don't really need it (South Platte). Except for the western San Juans, the updated 1 June SWE forecast expects 'above-normal' for our mountains, especially west of the divide.**

- **My statistical forecast for late spring (April-June) shows a slight tilt towards wetness covering the eastern plains which is good news for the Arkansas valley in particular. Mountains are less likely to end up wet, with the exception of the San Juans which now appear more favored than before. A first look at the monsoon season is surprisingly dry for much our state, but skill this far out has been poor.**

- **Given the rains of last September, an above-normal snowpack in the northern mountains, and a likely transition to El Niño, the stage is set for increased flood risk during the next six months, independend of the seasonal rainfall totals. *Individual weather events ('triggers') are still needed to realize the potential of this risk, but we should definitely be on 'high alert' status.***